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12.0 HOISTS, JIB CRANES, AND MONORAIL

12.1 SCOPE

This section applies to the following types of material handling equipment (see Attachment 12.1, “Equipment Types”) for handling freely suspended (unguided) loads:

1. Monorail systems
2. Jib cranes and hoists, including floor- and wall-mounted models
3. Overhead (underhung) hoists
4. Manually lever-operated hoists, chain type.

This section covers electric-powered, air-powered, and hand-operated equipment. Systems used for transporting personnel and specially insulated hoists used for handling electrically energized power lines require special considerations and are not included.

12.2 OPERATOR QUALIFICATIONS

Equipment within the scope of this section shall be operated only by the following qualified personnel:

1. Qualified operators (see Section 4.0, “Personnel Qualifications and Training Requirements”)
2. Trainees under the direct supervision of a designated person
3. Maintenance, inspection, and test personnel, when operation is necessary in the performance of their duties.

12.3 CONDUCT OF OPERATORS

The use of hoists is subject to hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care, common sense, and experience in anticipating the motions that will occur as a result of operating the controls.

12.3.1 Operator Practices—Powered and Manually Operated Equipment

The following practices are applicable to electric- and air-powered equipment, as well as manually operated equipment.

1. The operator shall not engage in any practice that will divert his or her attention while actually engaged in operating the equipment.
2. When physically or otherwise unfit, the operator shall not engage in the operation of equipment.
3. The supporting structure or anchoring means shall have a load rating at least equal to that of the hoist.
4. The operator shall avoid carrying loads over people.

5. The operator shall be familiar with operating controls of the equipment.
6. The operator shall respond to signals from the person directing the lift (designated leader), or an appointed signal person. When a signal person or designated leader is not required as part of the operation, the operator is responsible for the lifts. However, the operator shall obey a stop signal at all times, no matter who gives it.
7. Each operator shall be responsible for those operations under the operator's direct control. Whenever there is doubt as to safety, the operator shall consult with responsible management before handling the loads.
8. Hoists shall be used only in locations that will allow the operator to be free of the load.
9. The operator shall not operate a hoist that bears an out-of-order sign or is otherwise tagged out of service.
10. A welding electrode shall not be touched to the rope, chain, or any other part of the hoist or monorail system.
11. A wire rope, load chain, or operating chain shall not be used as a ground for welding.
12. The operator shall not adjust or repair a hoist. If adjustments or repairs are necessary, or any defects are known, the operator shall report the same promptly to an appointed person responsible for maintenance and repairs. The operator also shall notify the next operator of any remaining uncorrected defects at shift change.
13. Any hazardous conditions disclosed during operation shall be promptly reported to management. Hazardous conditions shall be corrected before normal operation is continued.
14. The operator shall not leave a suspended load unattended unless specific precautions have been instituted and are in place.
15. The load block of hoists should be lifted above head level for storage when the equipment is not in use.
16. Hand-operated equipment shall not be operated by other than the hand power of one operator at a time.
17. A lever extension ("cheater") shall not be used on manually lever-operated hoists.

12.3.2 Operator Practices—Powered Equipment

In addition to applicable practices described earlier, the following practices are relevant to electric- and air-powered equipment:

1. The operator shall not close the main line disconnect device until he or she is certain that no person is on, or adjacent to, the hoist or carrier.
2. If a tag, sign, or lock is found on the equipment, follow the Hanford Site Lockout/Tagout Program as applicable. Never remove locks, tags, or signs without proper authorization.

3. Before closing the main line disconnect of cab-operated equipment, the operator shall determine that all controllers are in the off position.
4. If power goes off during operation of cab-operated equipment, the operator shall immediately place all controllers in the off position. Before re-use, operating motions shall be checked for proper direction.
5. Contacts with stops or other carriers shall be made with caution. The operator shall do so with care for the safety of persons on or below the equipment, and only after making certain that any persons on other equipment are aware of what is being done.
6. Over-travel limit devices shall not be used as an operating control unless additional means are provided to prevent damage from over travel.
7. Controls of cab-operated monorail cranes shall be tested by the operator before beginning a new shift. If any controls do not operate properly, they should be adjusted or repaired before operations begin.
8. Persons boarding or leaving cab-operated monorail cranes should do so only at authorized locations and designated boarding entrances.

12.4 INSTALLATION

Hoists should be installed as recommended by the manufacturer. The supporting structure, including trolleys, monorail, or crane, shall be designed to withstand the loads and forces imposed by the hoist for the rated load. The following rules are applicable to temporarily installed and permanently installed equipment:

1. When hoists are used in hazardous locations, modifications to these rules and additional safety requirements may be necessary. If questions arise regarding the classification of an area, contact the responsible safety organization. (See Appendix A, "Definitions and Acronyms" **hazardous [classified] location**.)
2. When hoists are used to handle molten material, additional safety requirements may be necessary. (See ANSI Z241.2, *Safety Requirements for Melting and Pouring of Metals in the Metalcasting Industry*.)
3. Pendant controls on electric- or air-powered hoists should be located at a convenient level above the operating floor.
4. Proper over-travel limit protection shall be provided as required for the location and operating conditions.
5. Polyphase hoist motors shall be connected to the power supply such that hook motion agrees with the control marking. Internal connections in the hoist or pendant station wiring shall not be changed to accomplish this. Phase reversal (motor reversal), if necessary, shall be accomplished by reversing the power leads to the hoist unit.
6. Air-powered hoists shall be connected such that hook motion agrees with the control marking.

12.5 LOAD WEIGHT

1. No hoist shall be loaded beyond its rated load except for test purposes or for special overrated lifts as provided in para 12.5, item 2.
2. Planned engineered lifts are outlined in the ASME B30 standards. No such lift shall be made without the authorization of the U.S. Department of Energy, Hanford Hoisting & Rigging Program Manager.

12.6 ATTACHING THE LOAD

1. The hoist rope or chain shall be free from kinks or twists and shall not be wrapped around the load.
2. The load shall be attached to the load block or hook by means of slings or other devices. Hook point loading shall be avoided.
3. Care shall be taken to ensure that the load and slings clear all obstacles.

12.7 MOVING THE LOAD

1. The appointed person directing the lift (designated leader) shall ensure that the load is well secured and properly balanced and positioned in the sling or lifting device before it is lifted more than a few inches (centimeters).
2. Before starting to lift, the following conditions should be noted:
 - a. The load, sling, or lifting device is seated in the bowl of the hook.
 - b. The hoist chain or rope is not kinked.
 - c. Multiple-part lines are not twisted around each other.
 - d. The hook is brought over the load in such a manner as to minimize swinging when the load is lifted.
 - e. The chain or rope is properly seated on the chain sprocket or in the drum grooves and in the sheaves. (Pay special attention to this if there are or have been slack chain or rope conditions.)
 - f. The operator shall inch powered hoists slowly into engagement with a load, but should avoid unnecessary inching and quick reversals of direction.
 - g. During lifting, care shall be taken that:
 - (1) No sudden acceleration or deceleration of the moving load occurs
 - (2) The load does not contact obstructions.
 - h. Hoists shall not be used for side pulls except when specifically authorized by a qualified person who has determined the following:

- (1) The hoist rope or chain will not bear or rub against other members of the crane or hoist, except members specifically designed for such contact
 - (2) Such side pulls will not cause the hoist rope to be pulled out of the sheaves or across drum grooves
 - (3) Such side pulls will not result in excessive swinging of the load block or load.
 - (4) The stability of the equipment is not thereby endangered, and that various parts of the equipment will not be overstressed.
3. The operator shall not cause the hoist to lift, lower, or travel while anyone is on the load or hook.
 4. The operator shall avoid carrying loads over people.
 5. On rope hoists, the load shall not be lowered below the point where two wraps of rope remain on each anchorage of the hoisting drum, unless a lower limit device is provided, in which case no less than one wrap may remain on each anchorage of the hoist drum³
 6. When two or more hoists are used to lift a load, one appointed person (designated leader) shall be in charge of the operation. This person shall analyze the operation and instruct other personnel involved in the proper positioning and rigging of the load and the movements to be made.

12.8 GENERAL CONSTRUCTION AND INSTALLATION

12.8.1 Marking

The rated load shall be marked on the hoist or load block. In addition, hoists shall be marked with identification information as follows:

1. Hand-chain operated and manually lever-operated hoists:
 - a. Manufacturer's name
 - b. Manufacturer's model or serial number.
2. Electric-powered hoists:
 - a. Manufacturer's name
 - b. Manufacturer's model or serial number
 - c. Voltage of AC or DC power supply and phase.

³For overhead bridge and gantry cranes (Section 13), 29 CFR 1910.179 requires that no fewer than two wraps of rope shall remain on the drum, with or without a lower limit device.

3. Air-powered hoists:
 - a. Manufacturer's name
 - b. Manufacturer's model or serial number
 - c. Rated air pressure.

12.8.2 Warning Labels

12.8.2.1 Hand-Chain Operated Hoists. A label or labels shall be affixed to the hoist or load block of hand-chain-operated hoists. The label shall display the following information concerning operating procedures:

1. The word WARNING or other legend designed to bring the label to the attention of an operator
2. Cautionary language against any of the following:
 - a. Lifting more than the rated load
 - b. Operating the hoist with twisted, kinked, or damaged chain
 - c. Operating damaged or malfunctioning hoists
 - d. Lifting people or lifting loads over people
 - e. Operating hoists with other than manual power.

12.8.2.2 Manually Lever-Operated Chain Hoists. Lever-operated chain hoists shall have affixed to the hoist or load block, in a readable position, information concerning operating procedures as follows:

1. The word WARNING or other legend designed to bring the label to the attention of an operator
2. Cautionary language against any of the following:
 - a. Lifting more than the rated load
 - b. Operating the hoist when it is restricted from forming a straight line with the direction of loading
 - c. Operating the hoist with twisted, kinked, or damaged chain
 - d. Operating a damaged or malfunctioning hoist
 - e. Lifting people or lifting loads over people
 - f. Operating a hoist with lever extensions
 - g. Removing or obscuring a warning label.

12.8.2.3 Electric- or Air-Powered Hoists. Powered hoists shall have affixed to the hoist, load block, or controls, a label or labels displaying information concerning operating procedures as follows:

1. The word WARNING or other legend designed to bring the label to the attention of an operator

2. Cautionary language against any of the following:
 - a. Lifting more than the rated load
 - b. Operating a hoist when load is not centered under hoist
 - c. Operating a hoist with twisted, kinked, or damaged chain or rope
 - d. Operating a damaged or malfunctioning hoist
 - e. Lifting people or lifting loads over people
 - f. Operating a rope hoist with a rope that is not properly seated in its groove
 - g. Removing or obscuring a warning label.

12.8.2.4 Documented Evidence of Equivalent Training. Documented evidence of equivalent training of the users of the hoist, demonstrating that the information on the warning labels has been conveyed to, and understood by the users, will waive the requirement to maintain the labels.

12.8.3 Hand Signal Posting

Where hand signals are used, figures demonstrating standard hand signals for controlling hoist and crane operations shall be posted conspicuously at the job site (see Attachment 12.2, "Hand Signals").

12.8.4 Design Factors

12.8.4.1 Hand Chain-Operated Hoists and Manually Lever-Operated Chain Hoists. Load-sustaining parts are designed so that the static stress, calculated for the rated load, will not exceed 25 percent of the average ultimate strength. This requirement is commonly reflected by quoting a minimum design factor of 4 to 1.

12.8.4.2 Electric- or Air-Powered Hoists. Load-sustaining parts of powered hoists are designed so that static stress calculated for the rated load shall not exceed 20 percent of the average ultimate material strength. This requirement is commonly reflected by quoting a minimum design factor of 5 to 1.

12.8.4.3 Monorail Track. The capacity of monorail track is determined in accordance with ANSI MH 27.1, *American National Standard Specification for Underhung Cranes and Monorail Systems*. The allowable stress in the lower load-carrying track flange and hanger rods is 20 percent of the minimum ultimate strength of the material used. However, because other design elements must be considered, a simple "X to Y" design factor is not specified for monorail track systems.

12.8.5 Stops and Lugs

12.8.5.1 Stops on Jib Cranes and Monorails. Stops shall be provided at the ends of carrier travel. Stops or forks shall be provided at open ends of monorail track, track openers, and track switches. Stops shall be an integral part of a movable monorail track to prevent a carrier from running off either end of the movable track when the movable track is not in alignment with the stationary tracks.

12.8.5.2 Lugs on Jib Cranes and Monorail Carriers. Lugs or other means shall be provided to limit the drop of the carrier frame to 1 inch in case of wheel or axle failure, and shall be on both flanges of the track.

12.8.6 Sheave Guards

Sheaves carrying ropes, which can be momentarily unloaded, shall be provided with close-fitting guards, or other devices, to guide the rope back into the groove when the load is reapplied. Sheaves in the load block shall be equipped with close-fitting guards that will minimize the possibility of ropes becoming fouled when the load block is lying down with the ropes loose.

12.8.7 Over-Travel Protection

12.8.7.1 Lower Limit, Manually Lever-Operated, and Hand Chain-Operated Hoists. Before the load chain can be completely run out of the hoist, it shall be restrained in its fully extended position. The restraint shall be such that the unloaded hoist can withstand a lowering hand chain or operating lever force equivalent to twice the pull required to lift the rated load, or with the rated load on the hoist, a hand chain or operating lever force equivalent to the pull required to lift the rated load.

12.8.7.2 Lower Limit, Electric- or Air-Powered Hoists. The hoist shall not be installed where, during normal operating conditions, the hook can be lowered beyond rated hook travel unless the hoist is equipped with a lower limit device. Lower limit devices should be provided for hoists where the load block enters pits or hatchways in the floor.

12.8.7.3 Upper Limit, Electric- or Air-Powered Hoists. The hoist shall be so designed and constructed that the load hook, either loaded or empty, shall not exceed the upper limit of travel. In lieu of a limit switch, a mechanism such as a slip clutch may be used.

12.8.7.4 Travel Warning Devices. On cab- and remote-operated carriers, an audible or visual warning means shall be provided, unless it is impossible for personnel to work on the floor below the hoist.

12.8.8 Load Chain Bucket

If slack load chain presents a potential hazard to either personnel or equipment below the hoist, a device shall be installed to contain the slack load chain as it emerges from the hoist.

12.8.9 Hook Mousing and Throat Latches

Latch-equipped hooks shall be used for hoisting and rigging (H&R) operations unless the application makes use of the latch impractical or unsafe. The absence of a hook throat latch is not indiscriminately allowed (see para 5.3, "Throat Latches").

12.8.10 Monorail System, Clearance at Curves

Clearances shall be provided and maintained at the curves of a monorail system to allow for the swing of the load when negotiating the curve. The amount of clearance shall be determined by giving due consideration to the size, weight, and speed of the carrier and the radius of the track curve.

12.9 BRAKES—LOAD-CONTROLLING MECHANISM

12.9.1 Manually Lever Operated Hoists--Chain Type

The hoist shall be equipped with a friction brake that shall perform the following functions under normal operating conditions with test loads of up to 125 percent of the rated load.

1. Stop and hold the load when the lever force is removed.
2. Provide for incremental movement of the load when lifting or lowering.
3. Provide for adjustment where necessary to compensate for wear.

12.9.2 Hand Chain-Operated Hoists

A hand chain-operated hoist shall be so designed that, when the actuating force is removed, it will automatically stop and hold any test load up to 125 percent of the rated load.

12.9.3 Electric-Powered Hoists

Under normal operating conditions with a rated load and test conditions with test loads up to 125 percent of the rated load, a braking system shall perform the following functions:

1. Stop and hold the load when controls are released.
2. Limit the speed of the load during lowering, with or without power, to a maximum speed of 120 percent of rated lowering speed for the load being handled
3. Stop and hold the load in the event of a complete power failure
4. Provide for adjustment where necessary to compensate for wear.

12.9.4 Air-Powered Hoists

Under normal operating conditions with a rated load and test conditions with test loads up to 125 percent of the rated load, a braking system shall perform the following functions:

1. Stop and hold the load when controls are released
2. Prevent uncontrolled lowering of the load in the event of a loss of air pressure
3. Provide for adjustment where necessary to compensate for wear.

12.9.5 Cab-Operated Monorail

Cab-operated monorail cranes shall have travel brakes on the carrier. If parking brakes are provided they shall not prohibit the use of a drift point in the control circuit.

12.9.6 Monorail Carriers (No Cab)

On carriers, also known as trolleys, travel brakes are not required, provided that, in case of a power failure, the travel motion will stop within a travel distance equal to 10 percent of the rated load speed (feet/minute) when traveling at full speed with the rated load. If this requirement cannot be

complied with, a brake or noncoasting mechanical drive shall be provided. If parking brakes are provided on the carrier, they shall not prohibit the use of a drift point in the control circuit.

12.9.7 Jib Crane Carriers

Travel brakes are not required on jib crane carriers.

12.10 ELECTRICAL EQUIPMENT

12.10.1 National Electrical Code Compliance

Wiring and equipment shall comply with NFPA 70, *National Electrical Code*, Article 610, "Cranes and Hoists." When electric hoists are used in locations other than general indoor applications, control enclosures should be selected in accordance with NEMA ICS-6, *Enclosures for Industrial Control and Systems*.

12.10.2 Pendant Controls

1. **Pushbutton Station.** A pendant pushbutton station shall be supported so that the electrical conductors are protected from strain.
2. **Pendant Construction.** Makeshift field-fabricated pendants shall not be used. The voltage at pendant push-buttons shall not exceed 150 volts for AC and 300 volts for DC. Pendant control boxes shall be constructed to prevent electrical shock.
3. **Spring Return and Marked Pushbuttons.** Pushbuttons (except on/off buttons) shall spring-return to the off position when pressure is released by the operator. Buttons shall be clearly marked to identify their function.
4. **Resultant Motion.** To the extent possible, each control shall be marked to indicate the direction of resultant motion.

12.10.3 Electrical Supply, Hoist, and Monorail Systems

The electrical supply for hoists and monorail systems shall be controlled by a lockable switch or circuit breaker located on a fixed structure accessible from the floor. For temporarily installed hoists, a standard electrical connection (plug) that can be readily disconnected by the operator meets this requirement.

12.10.4 Monorail Conductors

Monorail conductors shall be guarded or located to minimize inadvertent contact with the conductor.

12.11 MODIFICATIONS

12.11.1 Monorail Systems

A monorail system may be modified or rerated, provided such modifications and the supporting structure are analyzed by a qualified person or the manufacturer of the equipment. A rerated system or one whose load-supporting components have been modified shall be subjected to a load test (see para 12.17.2, "Load Test"). The new rated load shall be displayed in accordance with para 12.8.1, "Marking."

12.11.2 Manual- or Power-Operated Hoists

Modifications to upgrade, rerate, or modernize hoist equipment shall be authorized only by the original equipment manufacturer or a qualified person. The new rated load shall be displayed in accordance with para 12.8.1, "Marking." Also see para 12.17.2, "Load Test," regarding load test requirements.

12.11.3 Documentation for Modifications

Documentation supporting rerating and modifications shall be retrievable and readily available to authorized personnel.

12.12 INSPECTION

Any hazardous conditions disclosed by inspection shall be corrected before use of the hoist or monorail system is resumed. Inspection requirements should be derived from information provided by the equipment manufacturer. Unless there is justification to do otherwise, the manufacturer's recommendations shall be followed. Inspection procedures should state the acceptance criteria for inspections and tests and shall be specific for the applicable make and model of equipment.

12.12.1 Initial Inspection

Before initial use, new, altered, modified, or extensively repaired hoists and monorail systems shall be inspected by a designated person to ensure compliance with the applicable ASME B30 standard.

B30.11, "Monorails and Underhung Cranes"

B30.16, "Overhead Hoists (Underhung)"

B30.21, "Manually Lever Operated Hoists."

12.12.2 Pre-Use Inspection

During each shift, before operating the hoist or monorail system, the operator shall perform a pre-use inspection. Management shall be notified of deficiencies. Deficiencies shall be carefully examined and a determination made as to whether they constitute a hazard. Pre-use inspection shall include the following operations:

1. Test all controls. If any controls do not operate properly, they should be adjusted or repaired before operations begin.
2. Unless the hoist has a slip clutch in lieu of an upper limit switch, verify operation of the primary upper-limit device. The trip-setting of the primary upper-limit switch shall be checked under no-load conditions by inching the block into the limit or running at slow speed.
3. Visually inspect all ropes and load chains. These visual observations should be concerned with discovering gross damage that may be a hazard.
4. Carefully scan the hoist for deficiencies that may occur between regular inspections.
5. Check that motions are smooth and regular with no hesitations, vibration, binding, unusual noise, or other irregularity.

12.12.3 Inspection Classification

Inspection of hoists and monorail systems in regular service is divided into two general classifications based on the intervals at which inspection should be performed. The intervals, in turn, depend on the nature of the equipment's exposure to wear, deterioration, or malfunction. The two general classifications are designated as **frequent** and **periodic**, with the following respective intervals.

12.12.3.1 Frequent Inspection Interval. Visual examination by the operator, with records not required, as follows:

1. Normal service—monthly
2. Heavy service—weekly
3. Severe service—daily.

NOTE: For service definitions see Appendix A, “Definitions and Acronyms,” **service**.

12.12.3.2 Periodic Inspection Interval. Visual inspection by a qualified inspector making records of apparent external conditions to provide the basis for a continuing evaluation, as follows:

1. Normal service, equipment in place—annually
2. Heavy service, equipment in place unless external conditions indicate that disassembly should be done to permit detailed inspection—semi-annually
3. Severe service, equipment in place unless external conditions indicate that disassembly should be done to permit detailed inspection—quarterly.

NOTE: For service definitions see Appendix A, “Definitions and Acronyms,” **service**.

12.12.4 Frequent Inspection

Items such as those listed in paras. 12.12.4.1 through 12.12.4.3 shall be inspected for defects and damage at intervals as defined in para 12.12.3.1, "Frequent Inspection Interval." This includes observations during operation for any defects or damage that might appear between periodic inspections (see para 12.3.1, "Operator Practices—Powered and Manually Operated Equipment," item 13, and para. 12.3.2, "Operator Practices—Powered Equipment," item 7). A designated person shall determine whether any defects or damage constitute a hazard that will require more detailed inspection.

12.12.4.1 Hoist, Hand Chain-, Electric-, and Air-Operated (see Tables 12-1 and 12-2). Deficiencies found during the following frequent inspections shall be examined carefully and a determination made as to whether they constitute a hazard:

1. Hoist functional operating mechanisms shall be operated and checked for maladjustment and listened to for unusual sounds that may indicate problems.
2. The functions of the hoist upper limit device of electric- or air-operated hoists shall be checked without a load on the hook at the beginning of each shift (see para 12.12.2, "Pre-Use Inspection"). Care shall be exercised. The load block shall be inched to its limit device or run in at a slow speed. Hoists may have a slip clutch in lieu of an upper limit switch. Unless recommended by the manufacturer, the frequent inspection does not test a slip clutch limit device.
3. Lines, valves, and other parts of hoist air systems shall be checked for leakage.
4. Hooks and latches shall be checked for deformation, chemical damage, cracks, and wear (see Section 5.0, "Hooks").
5. Hook latches, if used, shall be checked for proper operation.
6. Hoist rope shall be checked in accordance with para 8.3.1, "Frequent Inspection."
7. Welded-link hoist load chain shall be checked in accordance with para 12.14.1, "Welded-Link Chain Inspection," item 1.
8. Roller chain shall be checked in accordance with para 12.15.1, "Roller Chain Inspection," item 1.
9. Rope or load chain reeving shall be checked for compliance with recommendations of the hoist manufacturer.

Table 12-1. Inspection for Hand Chain-Operated Hoists.

Item	Normal service		Heavy service		Severe service	
	Visual monthly ^a	Record yearly ^b	Visual weekly ^a	Record semiannually ^c	Visual daily ^a	Record quarterly ^c
Frequent inspection (see para 12.12.3.1)						
All functional operating mechanisms for maladjustment and unusual sounds	X		X		X	
Hooks in accordance with Section 5.0	X		X		X	
Hook latch operation, if used	X		X		X	
Load chain in accordance with para 12.14.1 or 12.15.1	X		X		X	
Load chain reeving for compliance with hoist manufacturer's recommendations	X		X		X	
Periodic inspection (see para 12.12.3.2)						
Requirements of frequent inspection		X		X		X
Evidence of loose bolts, nuts, or rivets		X		X		X
Evidence of worn, corroded, cracked, or distorted parts such as load blocks, suspension housing, hand chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices		X		X		X
Evidence of damage to hook retaining nuts or collars and pins, and welds or rivets used to secure the retaining members		X		X		X
Evidence of damage or excessive wear of load sprockets, idler sprockets, or hand chain wheel		X		X		X
Evidence of worn, glazed, or oil-contaminated friction discs; worn pawls, cams, or ratchet; corroded, stretched, or broken pawl springs in brake mechanism		X		X		X
Evidence of damage to the supporting structure or trolley, if used		X		X		X
Warning label required by para 12.8.2.1, except as provided in para 12.8.2.4		X		X		X
End connections of load chain		X		X		X

^aBy operator or other designated personnel with records not required.

^bVisual inspection by a qualified inspector making records of conditions to provide the basis for a continuing evaluation.

^cAs in b, unless conditions indicate that disassembly should be done to permit detailed inspection.

Table 12-2. Inspection for Electric- or Air-Powered Hoists.

Item	Normal service		Heavy service		Severe service	
	Visual monthly ^a	Record yearly ^b	Visual weekly ^a	Record semiannually ^c	Visual daily ^a	Record quarterly ^c
Frequent inspection (see para 12.12.3.1)						
All functional operating mechanisms for maladjustment and unusual sounds	X		X		X	
Limit devices for operation	X		X		X	
Air lines, valves, and other parts for leakage	X		X		X	
Hooks in accordance with Section 5.0	X		X		X	
Hook latch operation, if used	X		X		X	
Hoist rope in accordance with para 8.3.1	X		X		X	
Load chain in accordance with para 12.14.1 or 12.15.1	X		X		X	
Rope or load chain reeving for compliance with hoist manufacturer's recommendations	X		X		X	
Periodic inspection (see para 12.12.3.2)						
Requirements of frequent inspection		X		X		X
Hoist rope in accordance with para 8.3.2		X		X		X
Evidence of loose bolts, nuts, or rivets		X		X		X
Evidence of worn, corroded, cracked, or distorted parts such as load blocks, suspension housing, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices		X		X		X
Evidence of damage to hook retaining nuts or collars and pins, and welds or rivets used to secure the retaining members		X		X		X
Evidence of damage or excessive wear of load sprockets, idler sprockets, and drums or sheaves		X		X		X
Evidence of excessive wear on motor or load brake		X		X		X
Electrical apparatus for signs of pitting or any deterioration of visible controller contacts		X		X		X
Evidence of damage to the supporting structure or trolley, if used		X		X		X
Warning label required by para 12.8.2.3, except as provided in para 12.8.2.4		X		X		X
End connections of load chain		X		X		X

^aBy operator or other designated personnel with records not required.

^bVisual inspection by a qualified inspector making records of conditions to provide the basis for a continuing evaluation.

^cAs in b unless conditions indicate that disassembly should be done to permit detailed inspection.

12.12.4.2 Jib Cranes and Monorail Systems. Deficiencies found during the following frequent inspections shall be examined carefully and a determination made as to whether they constitute a hazard:

1. Hoist inspection shall be in accordance with para 12.12.4, "Frequent Inspections," item 1.
2. All functional monorail and jib crane operating mechanisms shall be checked for maladjustment.
3. All tanks, valves, pumps, and other parts of air or hydraulic systems shall be checked for leakage.

12.12.4.3 Manually Lever-Operated Hoists, Chain Type (see Table 12-3). Deficiencies found during the following frequent inspections shall be carefully examined and a determination made as to whether they constitute a hazard:

1. All functional operating mechanisms shall be checked for maladjustment interfering with proper operation.
2. Hooks and latches shall be checked for deformation, chemical damage, cracks, and wear (see Section 5.0, "Hooks").
3. Hook latches, if used, shall be checked for proper attachment and operation.
4. The welded-link load chain shall be checked in accordance with para 12.14.1, "Welded-Link Chain Inspection, Replacement, and Maintenance," item 1.
5. The load chain reeving shall be checked for compliance with the recommendations of the hoist manufacturer or a qualified person.
6. The hoist lever shall be checked for bends, cracks, or other damage.
7. The hoist support shall be checked for damage.

12.12.5 Periodic Inspection

Periodic inspection shall be performed at intervals as defined in para 12.12.3.2, "Periodic Inspection Interval." These inspections may be performed with the hoist in its normal location⁴ and do not require the hoist to be dismantled. Covers and other items normally supplied to allow inspection of components should be opened or removed for these inspections.

⁴Inspections cannot be properly performed from the floor or ground level if the hoist is suspended above eye level. The intent is that inspections be performed at hoist level or that the hoist be lowered for inspection.

Table 12-3. Minimum Inspection for Lever-Operated Hoists--Chain Type.

Item	Normal service		Heavy service		Severe service	
	Visual monthly ^a	Record yearly ^b	Visual weekly to monthly ^a	Record semiannually ^c	Visual daily to weekly ^a	Record quarterly ^c
Frequent inspection (see para 12.12.3.1)						
All functional mechanisms for maladjustment interfering with proper operation	X		X		X	
Hoist support for damage	X		X		X	
Hooks and latches for deformation, chemical damage, cracks, and wear (See Section 5.0)	X		X		X	
Hook latch operation, if used	X		X		X	
Load chain in accordance with para 12.14.1	X		X		X	
Load chain reeving for compliance with the recommendations of the hoist manufacturer or a qualified person	X		X		X	
Lever for problems such as bends or cracks	X		X		X	
Periodic inspection (see para 12.12.3.2)						
Requirements of frequent inspection		X		X		X
Evidence of loose bolts, nuts, or rivets		X		X		X
Evidence of worn, corroded, cracked, or distorted parts such as load blocks, suspension housing, levers, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices		X		X		X
Evidence of damage to hook retaining nuts or collars, and pins and welds or rivets used to secure the retaining members		X		X		X
Evidence of damage or excessive wear of load sprockets or idler sprockets		X		X		X
Evidence of worn, glazed, or oil-contaminated friction disks; worn pawls, cams, or ratchet; corroded, stretched, or broken pawl springs in brake mechanism		X		X		X
Warning label required by para 12.8.2.2 except as provided in para 12.8.2.4		X		X		X
End connections of load chain, including over-travel restraints		X		X		X

^aBy operator or other designated personnel with records not required.

^bVisual inspection by a qualified inspector making records of conditions to provide the basis for a continuing evaluation.

^cAs in b, unless conditions indicate that disassembly should be done to permit detailed inspection.

12.12.5.1 Hoists, Hand Chain-, Electric-, and Air-Operated (see Tables 12-1 and 12-2). Deficiencies found during the following periodic inspections shall be carefully examined and determination made as to whether they constitute a hazard or whether complete disassembly is necessary. These inspections shall include the requirements of para 12.12.4, "Frequent Inspection," in addition to the following:

1. Bolts, nuts, and rivets shall be checked to ensure that they are not loose.
2. Load blocks, suspension housings, hand chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices shall be checked for evidence of wear, corrosion, cracks, or distorted parts.
3. Hook-retaining nuts or collars and pins and welds or rivets used to secure the retaining members shall be checked for damage.
4. Load sprockets, idler sprockets, hand chain wheel, and drums or sheaves shall be checked for evidence of damage or excessive wear.
5. Hand chain-operated hoists shall be checked for evidence of worn, glazed, or oil-contaminated friction disks; worn pawls, cams, or ratchets; and corroded, stretched, or broken pawl springs in braking mechanism.
6. Electric- or air-powered hoists shall be checked for evidence of excessive wear on motor and load brake.
7. The electrical apparatus of electric-powered hoists shall be checked for signs of pitting or any deterioration of visible controller contacts.
8. The slip clutch upper limit device, if so equipped, shall be checked in accordance with the manufacturer's recommendations.
9. The secondary upper limit switch and the lower limit switch, if the hoist is so equipped, shall be checked.
10. The supporting structure or trolley, if used, shall be checked for evidence of damage.
11. The presence and legibility of warning labels shall be checked as required by para 12.8.2.1, "Hand Chain-Operated Hoists," or 12.8.2.3, "Electric- or Air-Powered Hoists," except as provided by para 12.8.2.4, "Documented Evidence of Equivalent Training."
12. End connections on ropes or load chains shall be checked for evidence of wear, corrosion, cracks, damage, or distortion.
13. The hoist rope shall be checked in accordance with para 8.3.3, "Periodic Wire Rope Inspection."
14. The welded link hoist chain shall be checked in accordance with para 12.14.1, "Welded-Link Chain Inspection."
15. The roller chain shall be checked in accordance with para 12.15.1, "Roller Chain Inspection."

12.12.5.2 Jib Cranes and Monorail Systems. Deficiencies found during the following periodic inspections of jib cranes and monorail systems shall be carefully examined and a determination made as to whether they constitute a hazard or whether complete disassembly is necessary. These inspections shall include the requirements of para 12.12.4.2, "Jib Crane and Monorail Systems," in addition to the following:

1. The hoist inspection shall be in accordance with para 12.12.5.1, "Hoists, Hand Chain-, Electric-, and Air-Operated."
2. Members shall be checked for deformation, cracks, and corrosion.
3. Bolts, nuts, and rivets shall be checked to ensure that they are not loose.
4. Pins, bearings, wheels, shafts, gears, rollers, locking and clamping devices, bumpers, switch baffles, interlock bolts, and stops shall be checked for wear, cracks, or distortion.
5. Travel or parking brake system parts shall be checked for excessive wear.
6. Carrier (trolley) chain drive sprockets shall be checked for excessive wear and excessive chain stretch.
7. Electrical components such as, but not limited to, controllers, master switches, contacts, limit switches, and push-button stations shall be checked for deterioration.
8. Drive tires shall be checked for excessive wear.
9. The lower load-carrying flange of all track sections in the system, both straight and curved, shall be checked for excessive wear or deformation.

12.12.5.3 Manually Lever-Operated Hoists, Chain Type (see Table 12-3). Deficiencies found during the following periodic inspections shall be carefully examined and a determination made as to whether they constitute a hazard or whether complete disassembly is necessary. These inspections shall include the requirements of para 12.12.4.3, "Manually Lever-Operated Hoists, Chain Type," in addition to the following:

1. Bolts, nuts, and rivets shall be checked to ensure that they are not loose.
2. Load blocks, suspension housings, hand chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices shall be checked for evidence of wear, corrosion, cracks, or distorted parts.
3. Hook-retaining nuts or collars and pins and welds or rivets used to secure the retaining members shall be checked for damage.
4. Load sprockets or idler sprockets shall be checked for damage or excessive wear.
5. The brake mechanism shall be checked for worn, glazed, or oil-contaminated friction disks.
6. The presence and legibility of warning labels shall be checked as required by para 12.8.2.2, "Manually Lever-Operated Chain Hoists," except as provided by para 12.8.2.4, "Documented Evidence of Equivalent Training."

7. End connections of load chains, including over-travel restraints, shall be checked for deterioration.

12.12.6 Inspection of Equipment Not in Regular Use

1. Equipment, other than standby equipment, that has been idle for a period of 1 month or more, but less than 1 year, shall be given an inspection equal to a Frequent Inspection before being placed in service.
2. Equipment, other than standby equipment, that has been idle for a period of 1 year or more shall be given an inspection equal to a Periodic Inspection and an operating test (see para 12.17.1, "Operational Tests") before it is placed in service.
3. Equipment that is used for standby service shall receive a Periodic Inspection and an operating test (see para 12.17.1, "Operational Tests") no less than annually. Standby equipment exposed to adverse environmental conditions shall be inspected and tested more frequently as determined by the responsible maintenance organization.

12.12.7 Hook Inspection

Hooks shall be inspected in conjunction with the frequent and periodic hoist inspection. See Section 5.0, "Hooks," for hook inspection requirements.

12.12.8 Third-Party Inspection

A third-party crane/hoist inspection program is optional at the discretion of the Hanford Site contractor.

12.12.9 Inspection Records

Inspection records shall be kept for the life of the equipment. Following is a summary of inspection record requirements.

1. Initial Inspection—A record of the initial inspection shall be made.
2. Pre-use and Frequent Inspection—No records retention is required.
3. Periodic Inspection—The most recent records, dated and signed by a qualified inspector, shall be retained in the maintenance file.

12.13 WIRE ROPE INSPECTION, REPLACEMENT, AND MAINTENANCE

See Section 8.0, "Wire Rope," for rope inspection, replacement, and maintenance requirements.

12.14 WELDED-LINK CHAIN INSPECTION, REPLACEMENT, AND MAINTENANCE

12.14.1 Welded-Link Chain Inspection

1. The hoist shall be tested under load in lifting and lowering directions and the operation of the chain and sprockets shall be observed. The chain should feed smoothly into and away from the sprockets.
2. If the chain binds, jumps, or is noisy, it shall first be checked to ensure that it is clean and properly lubricated. If the trouble persists, the chain and mating parts shall be inspected for wear, distortion, or other damage.
3. The chain shall be examined visually for gouges, nicks, weld spatter, corrosion, and distorted links. The chain shall then be slackened and the adjacent links moved to one side to inspect for wear at the contact points. If wear is observed or if stretching is suspected, the chain should be measured according to the hoist manufacturer's instructions. If instructions are not available, the process shall continue as follows.
 - a. An unworn, unstretched length of the chain shall be selected (e.g., at the slack end).
 - b. The chain shall be suspended vertically under tension and, using a caliper-type gauge, the outside length of any convenient number of links shall be measured (approximately 12 to 24 inches overall).
 - c. The same number of links in the used sections shall be measured and the percentage increase in length shall be calculated.

12.14.2 Welded Link Chain Replacement

1. If the used chain exceeds the hoist manufacturer's recommended length, the chain shall be replaced. Or, in the absence of such recommendations, the chain shall be replaced if one of the following conditions exist.
 - a. For hand chain-operated or lever-operated hoists, the used chain is 2.5 percent longer than the unused chain.
 - b. For powered hoists, the used chain is 1.5 percent longer than the unused chain.

<p>CAUTION: Repairing of load chain by welding or any other means shall not be attempted by anyone other than the chain manufacturer.</p>
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2. Gouges, nicks, corrosion, weld spatter, or distorted links on the chain are sufficient to question chain safety and consider chain replacement. Safety in this respect depends largely on the use of good judgment by a qualified inspector in evaluating the degree of deficiency.
3. The replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer, unless otherwise recommended by the hoist manufacturer because of actual working conditions.

4. The load chain links that pass over the hoist load sprocket on edge (as opposed to those that lie flat in the pockets) shall be installed (if recommended by the hoist manufacturer) with the welds away from the center of the sprocket. This precaution is not required on idler sprockets, which change the direction but not the tension in the chain.
5. The chain shall be installed without any twist between the hoist and an anchored end on either the loaded side or the slack side.
6. When the chain is replaced, the mating parts (sprockets, guides, stripper) shall be disassembled and inspected for wear and replaced if necessary.
7. The load chain, discarded or new, shall not be used for slings.

12.14.3 Welded-Link Chain Maintenance

1. The load chain and hand chain should be kept clean and free from any coating or deposit that will build up and change their dimensions or reduce flexibility. The cleaning process shall not damage these chains, and any solution used in the cleaning process shall be acid-free.
2. The load chain articulates slowly under high bearing pressure and should be lubricated as specified by the hoist manufacturer or responsible maintenance organization. The hand chain is lightly loaded and normally requires no lubrication.

12.15 ROLLER CHAIN INSPECTION, REPLACEMENT, AND MAINTENANCE

12.15.1 Roller Chain Inspection

1. The hoist shall be tested under load in lifting and lowering directions and the operation of the chain and sprockets shall be observed. The chain should feed smoothly into and away from the sprockets.
2. If the chain binds, jumps, or is noisy, it shall first be checked to ensure that it is clean and properly lubricated. If the trouble persists, the chain shall be inspected as specified in the following items and the mating parts shall be inspected for wear, distortion, or other damage.
3. The roller chain should first be inspected while it is in the hoist. With the hoist suspended in normal position, a light load of approximately 50 pounds shall be applied.
 - a. Elongation shall be checked following the hoist manufacturer's instruction. In absence of specific instructions, the chain can be checked by determining the normal pitch and measuring a 12-inch section of chain that normally travels over the load sprocket. Using a caliper-type gauge, check the dimension from the edge of one chain pin to the corresponding edge of another pin for the number of pitches per foot. If elongation exceeds 0.25 inch in 12 inches, the chain shall be replaced. For example, a 0.75-inch-pitch chain should measure 12 inches over 16 pitches. Chain shall be rejected if measurement over 16 pitches exceeds 12.25 inches.
 - b. The chain shall be checked for twist. The chain shall be replaced if the twist in any 5-foot section exceeds 15 degrees.

- c. Straightness (side bow) in plane perpendicular to the plane of the rollers shall be checked. A chain that has a bow exceeding 0.25 inch in any 5-foot section shall be replaced.
- 4. Additional inspection of the chain should be made by removing the chain from the hoist and cleaning it thoroughly in an acid-free solvent. A check then should be made for any of the following deficiencies:
 - a. Pins turned from their original position
 - b. Rollers that do not run freely with light finger pressure
 - c. Joints that cannot be flexed by easy hand pressure
 - d. Side plates that are spread open (A visual check of the pin head extension at the damaged area, as compared to the pin extension at a free end of the chain, can determine the amount of spread and the condition of the chain.)
 - e. Corrosion, pitting, or discoloration of chain (generally indicative of serious impairment)
 - f. Gouges, nicks, or weld splatter.

12.15.2 Roller Chain Replacement

- 1. The roller chain shall be replaced if any of the conditions exist as stated in para 12.15.1, "Roller Chain Inspection," item 3. Repairing of roller chain by welding or heating shall not be attempted.
- 2. The existence of any of the deficiencies as stated in para 12.15.1, "Roller Chain Inspection," item 4, is reason for questioning chain safety and considering its replacement. Safety in this respect depends largely on the use of good judgement by a designated person in evaluating the degree of deficiency.
- 3. The replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer unless otherwise recommended by the manufacturer because of actual working conditions.
- 4. When the chain is replaced, the mating parts (sprockets, guides, stripper) should be disassembled and inspected for wear and replaced if necessary.
- 5. When the chain is replaced, it should be reeved in the manner recommended by the hoist manufacturer and should operate freely over all load and idler sprockets. All connecting links and chain end fasteners should be inspected and properly secured. The hoist manufacturer's recommendations should be followed on the selection and installation of connecting links.
- 6. Roller chains, discarded or new, shall not be used for slings.

12.15.3 Roller Chain Maintenance

1. Roller chains should be kept clean and free from rust. Excessively dirty chains should be soaked in a clean, acid-free solvent. Chains should be agitated to ensure that joints are free from grit and foreign matter.
2. Roller chains should be lubricated in accordance with hoist manufacturer's recommendations. In the absence of specific lubrication instructions, the chain should be lubricated with automotive oil, Society of Automotive Engineers (SAE) grade 20 or 30. Grease should never be applied to the chain.

12.16 MAINTENANCE

12.16.1 Preventive Maintenance

1. Refer to maintenance manuals provided by the manufacturer.
2. A preventive maintenance program based on the manufacturer's, or a qualified person's, recommendations shall be established.
3. Replacement parts shall be at least equal to the original manufacturer's specifications.

12.16.2 Maintenance Procedure

CAUTION: Adhere to established fall-protection requirements (guardrail system, safety net system, or personal fall-arrest system) when positioned on a walking or working surface with an unprotected side or edge that is 6 ft (2 m) or more above a lower level. Consult with your supervisor or occupational safety representative for specific details.

The following precautions shall be taken as applicable.

1. The hoist, monorail crane, or carrier (trolley) to be repaired shall be moved to a location where it will cause minimum interference with other equipment. Equipment that cannot be readily moved from its operating location can be maintained at the operating location, providing precautions are taken to ensure the safety of maintenance personnel and other personnel.
2. All controllers shall be placed in the off condition.
3. If the equipment is electrically powered, the main or emergency switch on the line feeding the hoist or monorail system shall be locked in the de-energized position, except as required to perform the maintenance. **Lock and tag procedures shall be strictly followed.**
4. If air-powered, the supply shall be disconnected or the valve on the air line feeding the hoist or monorail system shall be closed, except as required to perform the maintenance. **Lock and tag procedures shall be strictly followed.**

5. Effective markings and barriers shall be used where work creates a hazardous area on the floor beneath the equipment. Warning or "out of order" signs should be placed on the hoist. If personnel can access the equipment and signs are not visible from the floor beneath, place warning signs visible from the floor.
6. Only properly trained personnel shall work on energized equipment. Extra caution is required when working on energized equipment.
7. For monorail systems:
 - a. Where other carriers are operating on the same monorail track, temporary stops should be provided to prevent interference with the idle equipment.
 - b. Where temporary stops are not possible or practical, a signal person shall be placed at a vantage point for observing the approach of an active unit and warning its operator when it reaches a safe distance from the idle unit.
8. After adjustments and repairs have been made, the equipment shall not be restored to service until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.

12.16.3 Adjustments and Repairs.

1. Any hazardous conditions disclosed by inspection or during operation shall be corrected before normal operation of the hoist is resumed. Adjustments and repairs shall be done only by designated personnel.
2. Adjustments shall be maintained to ensure correct functioning of components. The following are examples:
 - a. All functional operating mechanisms
 - b. Limit devices
 - c. Control systems
 - d. Brakes.
3. Repairs or replacements shall be made as needed. The following are examples:
 - a. Hooks showing indications described in para 5.4.4, "Frequent Inspection."
 - b. All critical parts that are cracked, broken, bent, or excessively worn.
 - c. Pitted or burned electrical contacts should be corrected only by replacement and in sets. Controller parts should be lubricated as recommended by the manufacturer.
 - d. Function labels on pendant control stations shall be kept legible.
 - e. If repairs of load-sustaining members are made by welding, materials shall be identified and appropriate welding procedures shall be assigned by a qualified welding engineer, and welds shall be made by a qualified welding operator.

12.16.4 Hoist Rope Anchor

Replacement rope ends shall be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the hoist or rope manufacturer. For wire rope replacement requirements see para 8.4.1, "Wire Rope Replacement Criteria—Overhead and Gantry Cranes, Monorail Cranes and Hoists, Overhead Hoists."

12.16.5 Preoperational Check After Maintenance or Repair

A preoperational check shall be performed to verify the proper function of activities such as motion controls and interlocks. Special attention shall be given to those areas likely to have been affected by maintenance or repair.

12.16.6 Lubrication

Moving parts of the hoist for which lubrication is specified shall be regularly lubricated. Both manual and remote lubricating systems should be checked for delivery of lubricant. Care should be taken to follow manufacturer's recommendations as to points and frequency of lubrication, maintenance of lubricant levels, and types of lubricant to be used. Unless equipped for automatic or remote lubrication, hoist machinery and carriers shall be stationary while lubricants are being applied, except when lubricating chain or rope.

12.17 TESTING

12.17.1 Operational Tests

Before initial use, new, reinstalled, altered, repaired, or modified hoists that have not been used within the preceding 12 months shall be tested before being placed in service by or under the direction of a designated person to ensure that the hoist is in good operating condition, including the following functions:

1. Hand Chain-Operated and Manually Lever-Operated Hoists
 - a. Functions of the hoists, including lifting and lowering, shall be checked with the hoist suspended in the unloaded state. (Some hoists may require a nominal load or pull on the load line to test the lowering motion.)
 - b. After testing Manually Lever-Operated Hoists in the unloaded state, a load of at least 100 pounds (46 kg) times the number of load supporting parts of chain shall be applied to the hoist to check proper load control.
 - c. After testing Hand Chain-Operated Hoists in the unloaded state, a load of at least 50 pounds (23 kg) times the number of load supporting parts of chain shall be applied to the hoist to check proper load control.
2. Electric- or Air-Powered Hoists
 - a. Lifting and lowering (testing through complete rated lift length is not required)
 - b. Operation of brake(s)

- c. The trip-setting of primary limit devices shall be determined by tests under no-load conditions. Tests shall be conducted first by hand, if practical, and then under the slowest speed obtainable. Test with increasing speeds up to the maximum speed. Actuating mechanisms shall be located so that they will trip the switches or limiting devices in sufficient time to stop motion without damaging any part of the hoisting arrangement. On hoists with adjustable trip-setting limit devices, care shall be taken to achieve adjustment setting without the load block striking the hoist frame or without all the slack being taken out of the unloaded chain or with less than one wrap of rope on the drum.
3. Jib Crane and Monorail Systems
- a. Check hoist(s) as required in paragraph 12.17.1, "Operational Tests," item 1 or 2, as applicable.
 - b. Check carrier travel
 - c. Check travel-limiting devices
 - d. On monorail systems, check locking and safety devices for interlocking mechanisms, track switches, drop sections, and lift sections.

12.17.2 Load Test

1. Hand Chain-Operated and Lever-Operated Hoists
- a. New hoists shall be tested by the manufacturer with a test load of at least 125 percent of the rated load, except if testing of the hoist cannot be performed by the manufacturer, the test shall be accomplished by or under the direction of a person designated by the user (buyer).
 - b. Hoists in which load-suspension parts⁵ have been altered, replaced, or repaired shall be tested statically or dynamically by or under the direction of a designated person. The applied test load shall be at least equal to the rated load or greater as approved by the manufacturer. A record of the test shall be retained in the maintenance file. The replacement of load chain is specifically excluded from this hoist load test; however, an operational test shall be made in accordance with para 12.17.1, "Operational Tests," before returning the hoist to service.
 - c. Before a load test, test anchorages or suspensions will be checked to ensure that they will safely sustain the load.
2. Electric- or Air-Powered Hoists
- a. Complete new hoists shall be dynamically tested by the manufacturer as specified in para 12.9.3, "Electric-Powered Hoists," with a load of at least 125 percent of the rated

⁵Load-suspension parts of the hoist include the means of suspension (hook or lug), the structure or housing that supports the drum or load sprocket, the drum or load sprocket, the rope or load chain, the sheaves or sprockets, and the load block or hook.

load, except, if testing of the hoist cannot be performed by the manufacturer. If the manufacture cannot perform the hoist test, the test shall be accomplished by or under the direction of a person designated by the user (buyer). A record of the test shall be retained in the maintenance file.

- b. Hoists in which load-suspension parts have been altered, replaced, or repaired shall be tested dynamically by, or under the direction of, a designated person. The applied test load shall be at least equal to the rated load or greater as approved by the manufacturer. A record of the test shall be retained in the maintenance file. The replacement of load chain and rope is specifically excluded from this hoist load test; however, an operational test of the hoist under a normal operating load shall be made before returning the hoist to service. For testing after rope replacement see Section 8.0, "Wire Rope."
- c. Before a load test, test anchorages or suspensions will be checked to ensure that they will safely sustain the load.

3. Jib Crane and Monorail Systems

- a. Hoists shall be tested as specified in para 12.17.2, "Load Test," item 1 or 2, whichever applies.
- b. New, reinstalled, altered, repaired, and modified equipment should be load tested before initial use as determined by a qualified person. Load testing of altered, repaired, and modified equipment may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person.
- c. If a load test is conducted, the load shall be not less than 100 percent of the rated load of the equipment or more than 125 percent of the rated load of the equipment, unless otherwise recommended by the manufacturer. For equipment engineered on site, the responsible engineer or design authority has the authority otherwise taken by the manufacturer.
- d. If a load test is conducted, operations shall be performed as outlined in para 12.17.5, "Load Test Procedure," or as modified by a qualified person.

12.17.3 Periodic Load Test

Scheduled periodic load tests are not routinely required. Hoists may be load-tested up to 100 percent of rated capacity when or if specified by a Critical Lift Procedure. For hoists that frequently make critical lifts, especially if lifts are at or near rated capacity, a scheduled load-test program may be implemented. Such periodic load-tests shall not exceed the rated capacity. If a scheduled load-test program is implemented, a 5-year frequency is recommended.

12.17.4 Load-Test Weight

The load-test weight should be within a tolerance of (+0 percent, -5 percent) and shall be traceable to a recognized standard or verified by calculations.

12.17.5 Load-Test Procedures

Load tests shall be conducted in accordance with a written step-by-step procedure. A hold point shall be included in the load-test procedure to verify that inspection and maintenance is up to date. Load tests should be made where no critical items are installed, stored, or being worked on. The following guidelines are for information. Actual conditions may require changes to meet different situations and equipment configurations.

1. Verify that hoist inspection and maintenance is up to date.
2. State the type of load test. Example: "Special Test Before Critical Lift," "Test Before Returning to Service," or a "Rated Load Test."
3. State test loads used.
4. Lift the test load a few inches and hold for 5 minutes; from this position, lift an additional distance, not less than 3 feet above the floor (ground), and hold for 5 minutes. Then slowly lower the load; stop about 1 foot above the floor (ground), and hold for 5 minutes. At intermediate levels during hoisting and lowering, verify that the hoist operates properly and holds the load without slippage of more than 0.5 inch.
5. For electric- or air-powered hoists, at least once in a raising and once in a lowering condition, at a height of no more than 1 foot, disconnect the electric or air power source. The load shall stop immediately with less than 0.5-inch movement. There should be no slippage of the load or overheating of the brakes after 5 minutes of power off. The holding brakes should control the load throughout the test, and the load should not drop more than 0.5 inch when the lifting motion is again initiated.
6. For monorail and jib cranes, transport the test load with the carrier (trolley) over the trolley's entire range. For jib cranes, rotate the jib boom over the full range of motion while the carrier is at the outside end of the boom. Load transporting should be done with the test load approximately 1 foot or less above the floor (ground) or obstructions.
7. The test load should not rotate on the load block. Use taglines as appropriate. If the hook has power rotation, rotate the load through the full range of motion.
8. The hoist and carrier (trolley) shall function smoothly, without sticking or binding.
9. Following the load test, verify that no visible load-bearing part (e.g., gearing, shafting, bearing, rope or chain end-connection, brake components) has been adversely affected by the test.
10. Place the load test report in the maintenance file.

12.17.6 Hook Nondestructive Testing

Hook nondestructive testing (NDE) is not routinely required. If the hooks are to have NDE, the examination shall be done after the load test. If NDE is performed, attach the hook NDE report to the load test report.

12.18 MAINTENANCE FILES

The maintenance file is a compilation of various documents and records relating to operation, maintenance, inspection, testing, evaluating and repair of the equipment. The file may be centrally located or proportioned into satellite holding areas. The methods selected for establishing adequate information retention and retrieval shall be determined by the equipment custodian, who is the responsible person for ensuring that a safe and reliable maintenance program is in place.

12.18.1 Intent of Maintenance Files

The maintenance file shall contain, as a minimum, the required current dated periodic inspection records and other documentation to provide the user with evidence of a safe and reliable maintenance program. Inspection records should be retained in a format and location that allows easy accessibility. Maintenance file information should provide a source for comparing existing and past conditions to determine whether existing conditions show a trending pattern of wear, deterioration, or other similar factors that may compromise safe, continued use of the equipment. Length of record retention shall be determined by the equipment custodian's established maintenance program.

12.18.2 Maintenance File Contents

Maintenance files shall contain the following documentation, as applicable:

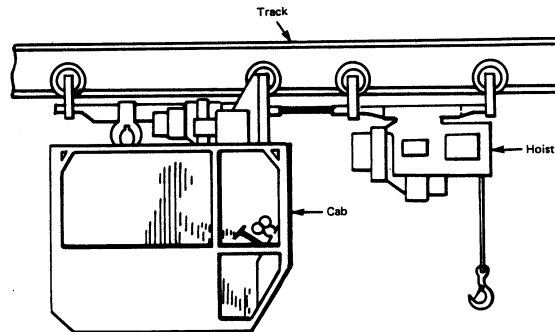
1. Periodic inspection records
2. Load test reports
3. Documentation of altered, replaced, or repaired load-sustaining parts
4. Records of special inspections on safety-related items such as brakes, hooks, ropes, hydraulic and pneumatic cylinders, and hydraulic and pneumatic pressure relief valves
5. Copies of waivers, exemptions, hostile environment plans, or similar documentation applicable to the equipment (to include manufacturer's safety bulletins, safety alerts, and product recall information)
6. Documentation for replacement ropes (see Chapter 8.0, "Wire Rope")
7. Wire rope manufacture's certification for replacement ropes.

NOTE: Although complete maintenance information for old equipment may not be available, the custodian should acquire as much of the pertinent information as possible.

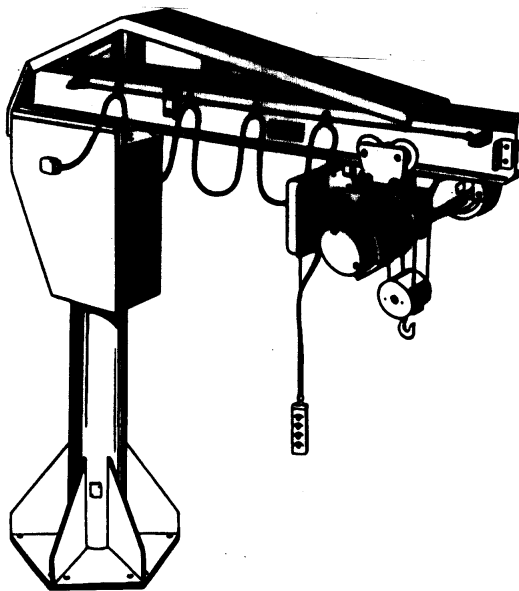
ATTACHMENT 12.1

EQUIPMENT TYPES

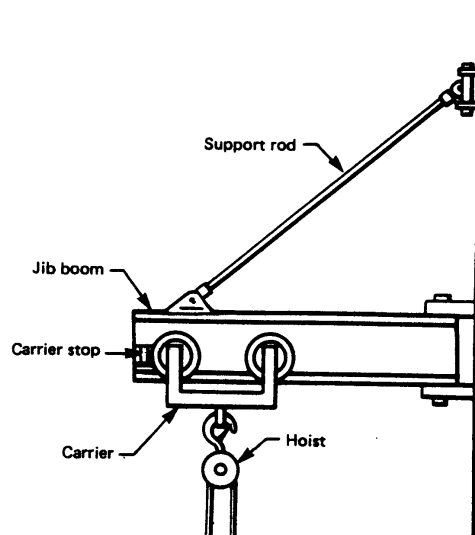
Attachment 12.1-1. Monorail Cab-Operated Carrier.



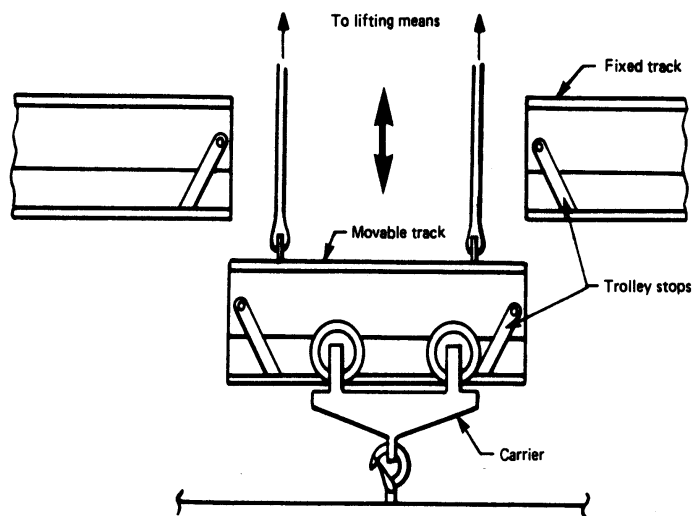
Attachment 12.1-2. Pedestal Jib Crane.



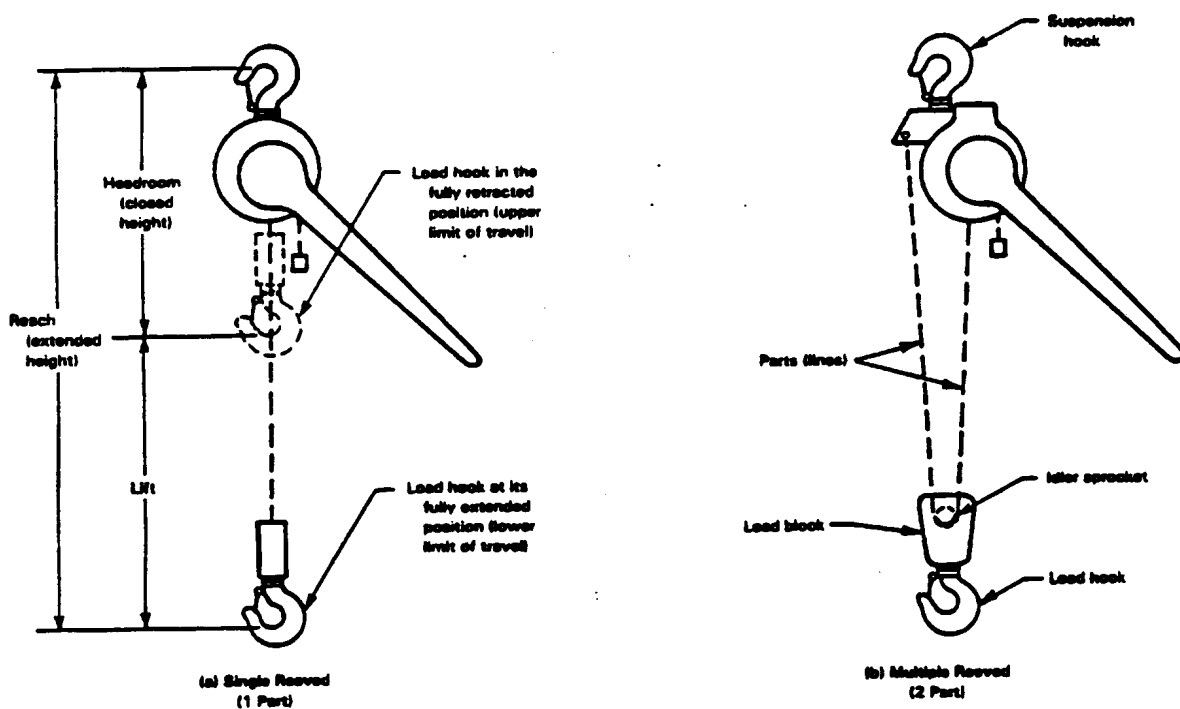
Attachment 12.1-3. Wall-Supported Jib Crane.



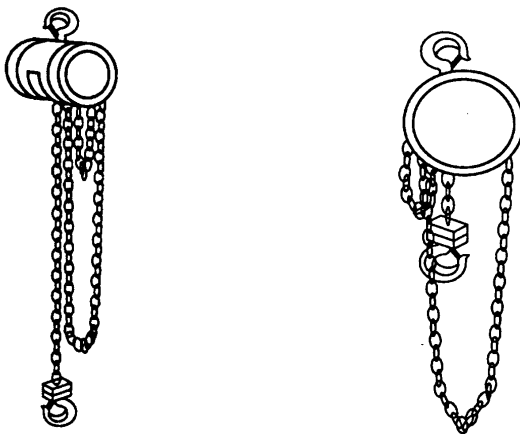
Attachment 12.1-4. Monorail Drop Section (Lift Section).



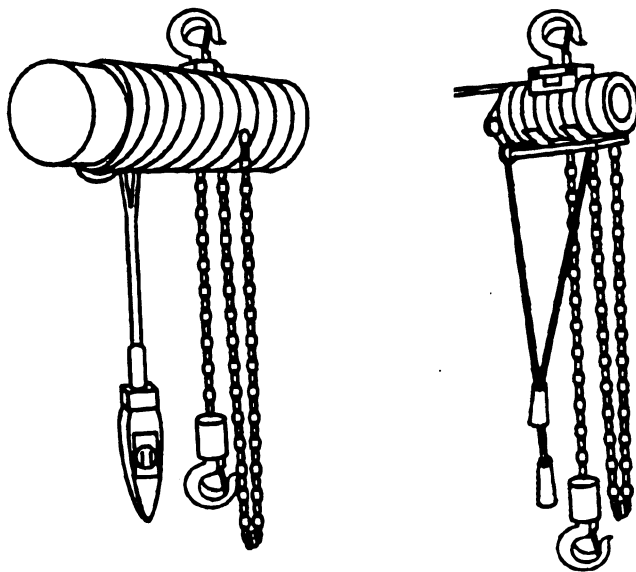
Attachment 12.1-5. Manually Lever-Operated Hoist--Chain Type.



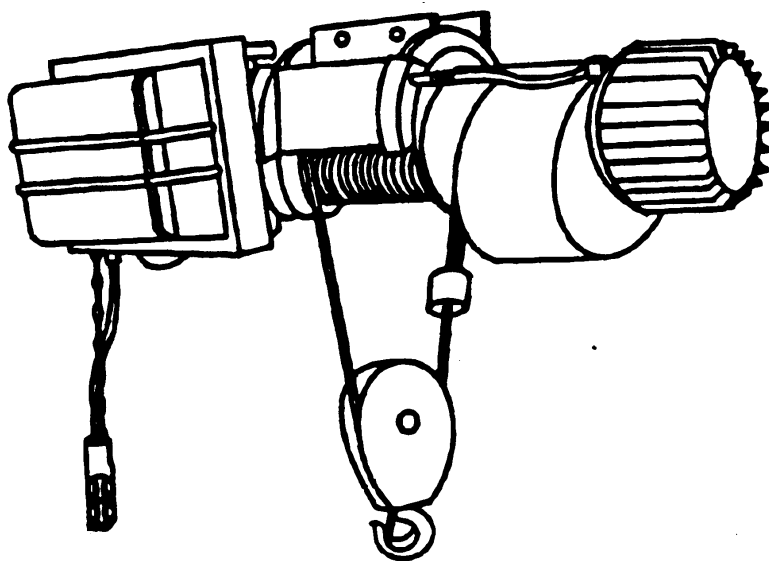
Attachment 12.1-6. Hand-Chain-Operated Chain Hoists



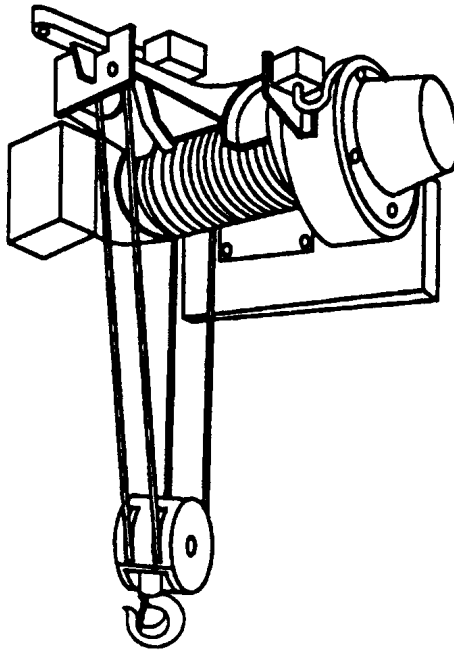
Attachment 12.1-7. Electric-Powered Chain Hoists



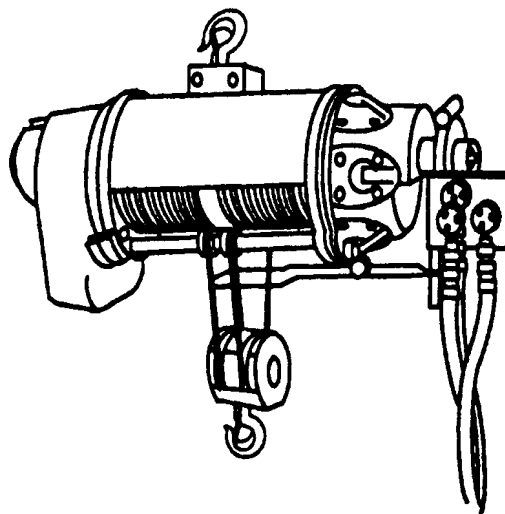
Attachment 12.1-8. Air-Powered Wire Rope Hoist.



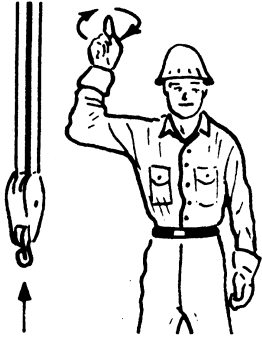
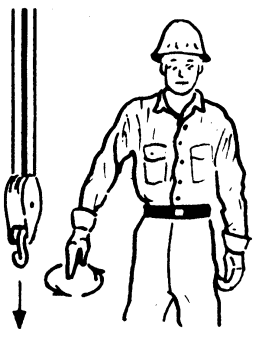
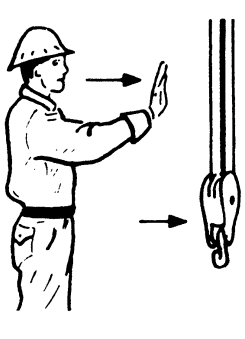

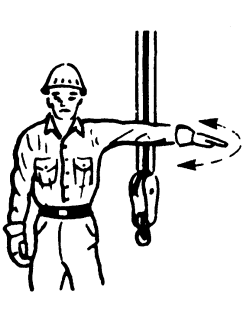
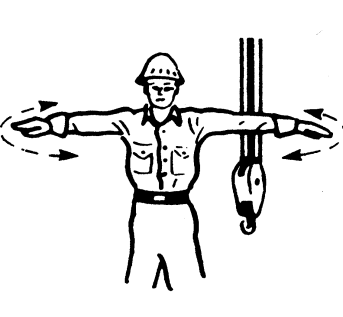
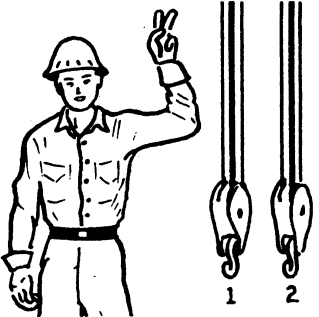
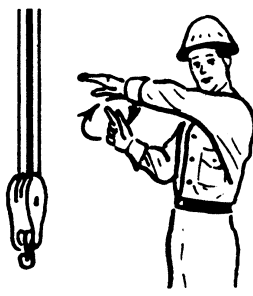
Attachment 12.1-9. Electric-Powered Wire Rope Hoist.



Attachment 12.1-10. Air-Powered Wire Rope Hoist.



Attachment 12.2. Hand Signals.

		
<p>HOIST</p> <p>With forearm vertical, forefinger pointing up, move hand in small horizontal circle.</p>	<p>LOWER</p> <p>With arm extended downward, forefinger pointing down, move hand in small horizontal circle.</p>	<p>BRIDGE TRAVEL</p> <p>Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>
		
<p>CARRIER TRAVEL</p> <p>Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.</p>	<p>STOP</p> <p>Arm extended, palm down, move arm back and forth.</p>	<p>EMERGENCY STOP</p> <p>Both arms extended, palms down, move arms back and forth.</p>
		
<p>MULTIPLE TROLLEYS</p> <p>Hold up one finger for block marked "1" and two fingers for block marked "2". Regular signals follow.</p>	<p>MOVE SLOWLY</p> <p>Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (<i>Hoist slowly</i> shown as example).</p>	